File 605 TO 8
CSR

25X1

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(IN TRIPLICATE)

22 September 1960

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Attention: [redacted]

Subject: Progress Reports,
Submission of

Enclosure: (A) Progress Reports for the
month of August, in quadruplicate

Gentlemen:

Pursuant to the terms and provisions of the applicable task orders and contracts, the contractor submits Enclosure (A), described above, detailing the progress achieved during the month of August 1960.

In the event further information is desired concerning the enclosed reports, do not hesitate to contact the writer.

Very truly yours,

25X1

[redacted]

Contract Administrator

NKG:dw

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PROGRESS REPORT
FOR
MONTH OF AUGUST 1960

BROADBAND ANTENNA, FILTER AND DETECTOR SYSTEMS

Purpose: To develop a system of antennas, filters and detectors for the 50 mc to 40,000 mc frequency range.

Personnel: Electrical Engineers:

Mechanical Engineer:

Mathematician:

25X1

Status: The detecting device which consists of a special Sage Laboratories, Inc. tripolar crystal holder having a TNC input connector and an MB output connector with a 1N358A tripolar crystal mounted in the holder has been tested over the entire frequency range from 50 mc to 10,000 mc with satisfactory results. Average tangential sensitivity[a] readings of several crystals and holders were approximately -50 $\pm$ 2 dbm. This detector unit will be used with the various antenna and filter systems which cover the 50 mc to 10,000 mc frequency range.

Modified logarithmically periodic (abbreviated LP) antennas covering a 10 to 1 frequency bandwidth from 50 mc to 500 mc are under construction. The antenna is designed to have a lower frequency limit of 200 mc but will be used below cutoff to 50 mc because of the physical requirements of the system. Prototypes of this antenna

[a]Tangential sensitivity measurements are obtained by feeding a 10 microsecond duration, 1000 cycle per second repetition rate, pulse modulated RF signal to the input of the detecting device. The output of the detector is then fed into a video amplifier and the output of the amplifier is displayed on an oscilloscope. A tangential signal is defined as that input signal which will produce an output signal whose amplitude is twice the amplitude of the system noise level.

have been tested both for radiation pattern characteristics and for impedance characteristics. Satisfactory results were obtained in both tests. However, as was expected below the 200 mc cutoff frequency, the operation of the antenna deteriorates markedly. The final models of these antennas will consist of wire braid sewn onto fungus proofed shirt cloth. The feed cables, filters and detectors will be secured to the surface of the antenna with snaps for ease in change and removal.

Final models of the 500 mc to 1000 mc LP printed circuit antennas have been constructed and tested both for pattern and for impedance performance with satisfactory results. The antenna elements are etched onto a teflon-glass board and after placement of the feed lines and connectors, the unit is gold plated to resist deterioration by exposure. This antenna is a truncated version of a 500 mc to 10,000 mc prototype printed antenna.

A prototype 1000 mc to 10,000 mc LP antenna has been tested. The impedance and pattern behavior are satisfactory over the 10 to 1 frequency bandwidth. This antenna is obtained by removing the lower frequency elements from the 500 mc to 10,000 mc prototype antenna.

Final models of the 10,000 mc to 40,000 mc horn antenna and waveguide detector assembly are under construction. A prototype antenna and detector have been tested with satisfactory results over the entire frequency range. The filters for use with this antenna exhibit high pass characteristics and make use of the natural and dielectric loaded lower cutoff nature of the waveguide which connects to the horn antenna. For the 30,000 mc to 40,000 mc

frequency range the antenna and waveguide assembly operate under normal conditions; specifically, with air as the dielectric medium. For this condition, the waveguide has a natural cutoff at approximately 26,500 mc. Operation over the 20,000 to 40,000 mc frequency range is obtained by loading the waveguide with plexiglass (dielectric constant approximately equal to 2.5) in such a manner that the cutoff frequency of the waveguide is lowered to approximately 17,000 mc. The plexiglass material is also extended into the throat of the horn antenna to insure satisfactory propagation of the energy incident at the aperture of the antenna into the dielectric loaded waveguide. Operation over the entire frequency range from 10,000 mc to 40,000 mc is accomplished by inserting into the waveguide a different material with a dielectric constant approximately equal to 14. This material is extended into the throat of the horn for the same reason as was the plexiglass insert. The high pass filtering characteristics of the air dielectric, plexiglass dielectric and high dielectric equal to 14 have been satisfactory.

Bandpass filters for use with the 50 mc to 500 mc cloth antenna have been purchased from Microphase Corporation. The 50 mc to 100 mc and 100 mc to 200 mc filters have been delivered and preliminary system evaluation has been initiated using the prototype cloth antenna. The filtering characteristics of the filters are satisfactory. The 200 mc to 500 mc bandpass filters are on order and should be delivered during the next month.

A prototype 2000 mc to 4000 mc transmission line bandpass filter has been constructed and tested with satisfactory results. The design criteria is a modified version of the procedure which was

programmed on the IBM 650 and utilizes insertion loss and image parameter techniques in combination. The design obtained for the 2 to 1 bandwidth filter above need only be scaled in size to make it applicable to the other octave frequency ranges. The 2000 mc to 4000 mc bandpass filter insertion loss vs. frequency response is shown in Figure 1 to indicate the progress of the filter development program. The test results demonstrate adequately the possibility of constructing a bandpass filter using transmission line techniques to give the desired skirt and passband characteristics. The prototype filter does not in its present condition conform to the size requirements as specified in the contract. To rectify this situation, a filter which is loaded with dielectric material is being constructed. In addition, the filter will be folded to decrease its overall length to acceptable dimensions. A prototype 8,000 mc to 10,000 mc stripline filter is being constructed and work has been initiated to construct prototype 500 mc to 750 mc and 750 mc to 1000 mc transmission line bandpass filters. In addition to the basic filter design, a low pass filter section must be included with the bandpass filter to insure satisfactory stop band protection to frequencies beyond the usable range of the associated antenna. This will be accomplished by using either a series stub or a low pass end section as an integral part of the bandpass filter unit. It is understood that the effects of loading the filter with dielectric and folding the filter to further reduce the physical dimensions will introduce additional attenuation and reflection in the passband, however, these degradations should not impair the satisfactory performance of the receiving system.

Future Plans: Sensitivity evaluation of the 50 mc to 500 mc antenna, filter and detector systems has been started. Some problems are being encountered in matching the crystal detector unit input impedance to the output impedance of the bandpass filters for this frequency range, but it is presumed these difficulties will soon be resolved. All components of this system (with the exception of the 200 mc to 500 mc filter which has not been delivered) function individually as desired. The present effort is being directed toward integration of the separate units into a complete system.

Prototype filters for the 500 mc to 10,000 mc frequency range are being assembled and tested as they are received from the model shop. System sensitivity evaluation of the assemblies covering this frequency range will be delayed until final models of the filters are constructed.

As indicated above, the final models of the 10,000 mc to 40,000 mc horn antenna, detector and waveguide inserts are under construction. System evaluation of these units will be delayed until the 36,000 mc to 39,700 mc klystron is replaced in the high frequency tuning unit of the Polorad EHF signal generator. Preliminary system sensitivity measurements have been satisfactory.

PROGRESS REPORT
FOR
MONTH OF AUGUST 1960

400-4000 MC PARABOLIC RECEIVING ANTENNA

Purpose: To design, develop and fabricate a receiving antenna with accompanying preamplifier to cover the 400 to 4000 mc frequency range.

Personnel: Electrical Engineer:

Mechanical Engineers:

25X1

Status: Work has been progressing very rapidly on this project, and it is predicted that we will deliver well ahead of schedule, probably within the next 2 weeks.

All mechanical work is near completion. The control panel is completed, and the wiring of the pedestal and amplifier box is in the advanced stages. The rotator for the feed is complete. The traveling wave amplifiers have been received from Menlo Park and the necessary modifications have been made.

Future Plans: Testing of the feed will be done within several days and final testing of the complete system should be done within a week. The only foreseen delay could result from a delay in receiving the connectors for the Spir-O-Line coaxial cable.

PROGRESS REPORT
FOR
MONTH OF AUGUST 1960

1-10 KMC ANTENNA

Purpose: To design, develop, and construct five 1-10 KMC antennas.

Personnel: Electrical Engineer: [redacted] 25X1

Mechanical Engineer:

Status: Since the requirements of this project quite closely parallel the requirements of EP 39-1393, the subject project will not become active until completion of EP 39-1393.

SWR

Antenna and balun tested with ~~√~~ may SWR 2.8 to 1.

Further effort is being directed toward reducing the SWR. Radiation patterns

psi 40° are

PROGRESS REPORT
FOR
MONTH OF AUGUST 1960

TRANSPORTABLE INFLATABLE ANTENNAS

Purpose: To construct and fabricate three transportable inflatable antennas with indoor mounts only.

Personnel: Electrical Engineer: [redacted]

Mechanical Engineer:

25X1

Status: All parts have been ordered and some received from the model shop.

Future Plans: Construction will begin about 15 September.

PROGRESS REPORT
FOR
MONTH OF AUGUST 1960

AN-20 ANTENNA

Purpose: To construct one broadband type AN-20 antenna with frequency range of 55-600 mc for use with the CS-8 Collection System.

Personnel: Electrical Engineer: [redacted] 25X1

Mechanical Engineer: [redacted]

Status: All parts were ordered early in the month, however, there was a delay in the receipt of certain of the purchase parts. The model shop parts have been found to be satisfactory mechanically.

Future Plans: Testing and shipping will coincide with the receipt of the final purchase parts.

PROGRESS REPORT
FOR
MONTH OF AUGUST 1960

CS-8 LPS ANTENNA

Purpose: Construct three CS-8 LP antennas with indoor mounts only.

Personnel: Electrical Engineer: [redacted] 25X1

Mechanical Engineer:

Status: All purchase parts have been ordered.

Future Plans: The model shop parts will be ordered during the first week of the month.

PROGRESS REPORT
FOR
MONTH OF AUGUST 1960

ELECTROMAGNETIC HORN ANTENNA

Purpose: To construct a system of antennas, filters and detectors for the 10,000 mc to 40,000 mc frequency range and a system of antennas and filters for the 50 mc to 10,000 mc frequency range.

Personnel: Electrical Engineer: [redacted] 25X1

Status: The 1N53R crystals have been received for the waveguide detector assemblies. The short sections of waveguide to be used in conjunction with the horn antennas have been received. Prototype transmission line filters covering the 500 mc to 10,000 mc frequency are under construction.

Future Plans: Construction of the horn antennas will begin during the next period. Materials will be ordered during the next period for construction of the 50 mc to 500 mc antenna.